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Immediate Effect of Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation Stretching on Calf Muscle Flexibility Among University Level Recreational Athletes – A Randomized Clinical Trial

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Abstract

[Objective] To assess and compare the immediate impact of muscle energy technique (MET) and proprioceptive neuromuscular facilitation (PNF) stretching on calf muscle flexibility in recreational athletes. [Method] A total 30 individuals participating in recreational activities were divided into two groups: Group A, which followed the MET protocol, and Group B which followed the PNF protocol. The range of motion (ROM) of ankle dorsiflexion was evaluated before and after the intervention. [Results] Analysis of data was conducted using non-parametric testing. The data within the group was examined using Wilcoxon signed rank test. The data was compared between group with Mann Whitney U test. The outcome was determined to be statistically significant (p value 0.001) for every group. Inter group analysis revealed a p value <0.05, indicating a substantial disparity in the effects of the two therapies. [Conclusion] In conclusion, both MET and PNF stretching techniques have an immediate impact on the flexibility calf muscle. However, MET has been demonstrated to be more efficient than PNF stretching in enhancing flexibility of the calf muscle.

Keywords

Muscle energy technique, Proprioceptive neuromuscular facilitation, Calf muscle flexibility

Introduction

Flexibility has been an important physiological component of physical fitness among athletes. Flexibility refers to the ability of the joint or group of joints and muscles to effectively move through an unrestricted and pain free range of motion (Kisner & Colby, 2007). The calf muscle is located at the posterior aspect of leg and is composed of the soleus muscle, the medial and lateral heads of the gastrocnemius (Tardoli, 2012). Ankle joint ROM is crucial for daily activities and sports performance (Rodacki et al., 2009). Tightness in the calf muscle is common, even in young, healthy individuals and recreational athletes, often leading to strain injuries (Roig Pull, 2007). Stretching of the muscle is performed as a routine protocol to improve or increase flexibility and to prevent muscle damage. Stretching is universally recommended by athletes, coaches, trainers or physiotherapists, to prevent injury and enhance performance (Thacker et al., 2004). Various methods are used to evaluate tightness of calf

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muscle. The weight bearing lunge test or knee-to-wall test is a reliable method for assessing tightness in the calf muscles (Gohil & Tilaye, 2022). The pre-contraction elongation which involves the contraction of muscles before their stretching is a part of manual therapy and is termed as the muscle energy technique (MET) (Chaitow, 2001). It has been successfully applied among athletes to improve the length of muscles that lack flexibility (Moore et al., 2011). Proprioceptive neuromuscular facilitation (PNF) has been proved to be effective in improving the muscle elasticity as well as the joint ROM. PNF stretching involves elongation and shortening of a focused muscle group (Hindle et al., 2012). Flexibility of calf muscles has improved, according to several research on the efficacy of various methods. However, the primary driving force behind this investigation was to compare the immediate effects of MET and PNF on calf muscle flexibility.

Methodology

Participants recruitment

A total of 36 individuals engaged in recreational sports were recruited for this randomized trial using purposive sampling method. After screening 36 participants, we selected only 30 who met the inclusion criteria for the study. Recreational athletes such as runners, football players and cricket players aged 17-25, both genders and Weight bearing lunge test value less than 12 cm were included in the study (Gohil & Tilaye, 2022). Participants were excluded if they had a history of ankle injuries, neurological disorders, knee flexion contracture, history of surgeries in lower limb. The participants were allocated into two groups using a basic randomization approach known as flipping a coin. Group A was given a single session of MET, whereas group B received a single session of PNF. A blinded assessor examined the range of motion for ankle dorsiflexion before and immediately after the intervention, without knowledge of the participants' group.

Ethical approval

The study was approved by Institutional research and ethical committee. All participants were given a full description of the study's objectives, and informed consent was acquired. The participants were also informed about the importance of maintaining data confidentiality and were given the option to withdraw from the study at any time. Confidentiality of the data was maintained by securely storing the data and access was restricted to the researchers of this study only.

Intervention procedure

Group A received MET (Muscle Energy Technique) treatment. The participants were asked to lie on their backs with their knees bent over a rolled towel. They were then directed to do isometric plantarflexion utilising no more than 20% of their maximum strength, while maintaining regular breathing. The participants were instructed to maintain the contraction for a duration of 7–10 seconds. The ankle was dorsiflexed to the new barrier passively without stretch and held for up to 30 seconds. The process was repeated three times in a single session of 10 minutes. Group B participants underwent PNF (hold-relax) stretching while resting supine with their legs extended. The therapist directed the foot towards dorsiflexion until it reached a point of discomfort. Next, the participants were directed to engage in a maximal isometric contraction of the muscle that is causing the restriction. The calf muscle undergoes passive stretching once the contraction is maintained for a duration of 20 seconds. The process was executed three times in a single session of 10 minutes.

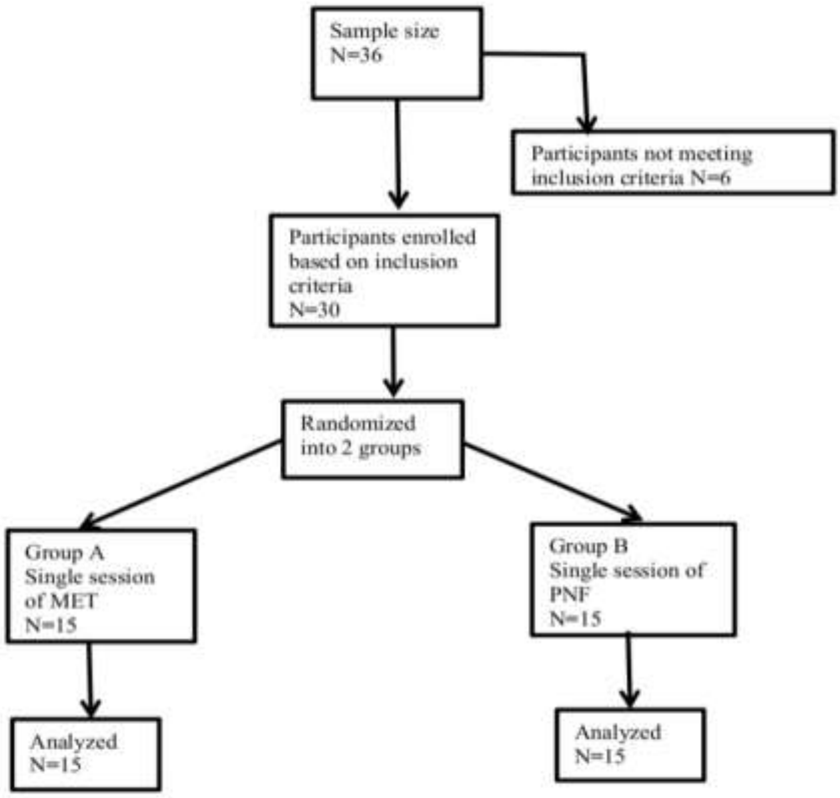

Figure 1. Allocation chart

Statistical analysis

The data analysis was conducted with SPSS version 26.0, employing a confidence interval of 95%. A p value less than 0.05 was deemed statistically significant. The normality of the data was evaluated using the Shapiro-Wilk test (Hicks, 2004). An analysis was performed using a non-parametric test, namely the Wilcoxon signed rank test, on the data within the group. The data was compared between groups using the Mann-Whitney U test.

Results and Discussion

Table 1 represents the basic demographic of the participants with a mean age of 20.56±1.07. Both groups were similar at baseline. A significant change in result was found with p value 0.001 for within group analysis for ankle dorsiflexion range of motion shown in Table 2.

Table 3 shows a mean difference in ankle dorsiflexion range of motion of 5.0 ± 1.10 and 2.7 ± 1.51 in MET and PNF group respectively with a statistically significant difference ($p<0.05$) between the intervention group.

Table 1. Gender and age distribution of participants.

Gender	Group A	Group B	Mean±SD
Male	8	7	
Female	7	8	
Age			20.56±1.07
BMI			20.45±1.03

Table 2. Mean difference in ankle dorsiflexion ROM within groups.

Group	Pre-intervention	Post- intervention	z value	p value
	Mean±SD			
Group A (MET)	10.8±1.74	16.3±1.63	-3.320	0.001
Group B (PNF)	10±1.80	13.9±1.30	-3.210	0.001

Table 3. Mean difference in ankle dorsiflexion ROM between the groups

Outcome	Group A (MET)	Group B (PNF)	U value	p value
Dorsiflexion	5.0 ± 1.10	2.7 ± 1.51	31.500	0.010

The purpose of the study was to assess the immediate effects on calf muscle flexibility in recreational athletes between the muscle energy technique and proprioceptive neuromuscular facilitation stretching (hold-relax technique). Our data analysis showed that both group A and group B significantly improved. Intergroup comparison, however, showed that group A, which received MET, had a greater impact on increasing the flexibility of the calf muscles than did group B, which received PNF stretching.

Lack of flexibility is frequently mentioned as the primary cause of muscle strain injuries (Roig Pull, 2007). The physiological processes that support muscular extensibility-reflex relaxation- can be used to explain the improvement in range of motion following intervention with the muscle energy technique approach (Chaitow, 2001). Muscle extensibility would increase in response to changes in the biomechanical and neurophysiological elements of the muscle (Arun et al., 2018). Adkitte et al. (2016) conducted a study on the impact of MET on hamstring muscular flexibility in Indian National football players found that MET makes football players' hamstring muscles more flexible, which can help them avoid injuries. Other physiological mechanisms are associated with various neurologic and biomechanical factors including hypoalgesia, proprioception, motor programming and control and changes in tissue fluids (Kang et al., 2023). Research has demonstrated that greater stretch tolerance can lead to instantaneous changes in range of motion (Ballantyne et al., 2003).

Numerous research studies have indicated significant increase in range of motion (ROM) following a single session of proprioceptive neuromuscular facilitation (PNF). This improvement is thought to be attributed to autogenic inhibition, where the isometric contraction phase boosts activity in Ib muscle afferents (Hindle et al., 2012). Nakamura et al. (2015) observed a reduction in muscle stiffness following hold-relax stretching in young adults. By encouraging spontaneous muscular contraction and relaxation to lessen nerve reflex factors that trigger muscle contraction, PNF stretching improves range of motion (Choi J. et al 2022). In our study, we found that muscle energy technique (MET) had a greater impact on calf muscle flexibility. One of the significant limitations of the study is limited sample size. Therefore, future study should focus for larger-scale studies and by conducting a follow-up, whether the intervention has long lasting impact, can be determined.

Conclusion

Our findings indicate that both MET and PNF stretching have an immediate impact on enhancing calf muscular flexibility. However, MET (Post-Isometric relaxation) demonstrates a more pronounced effect compared to PNF stretching in improving calf muscle flexibility.

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